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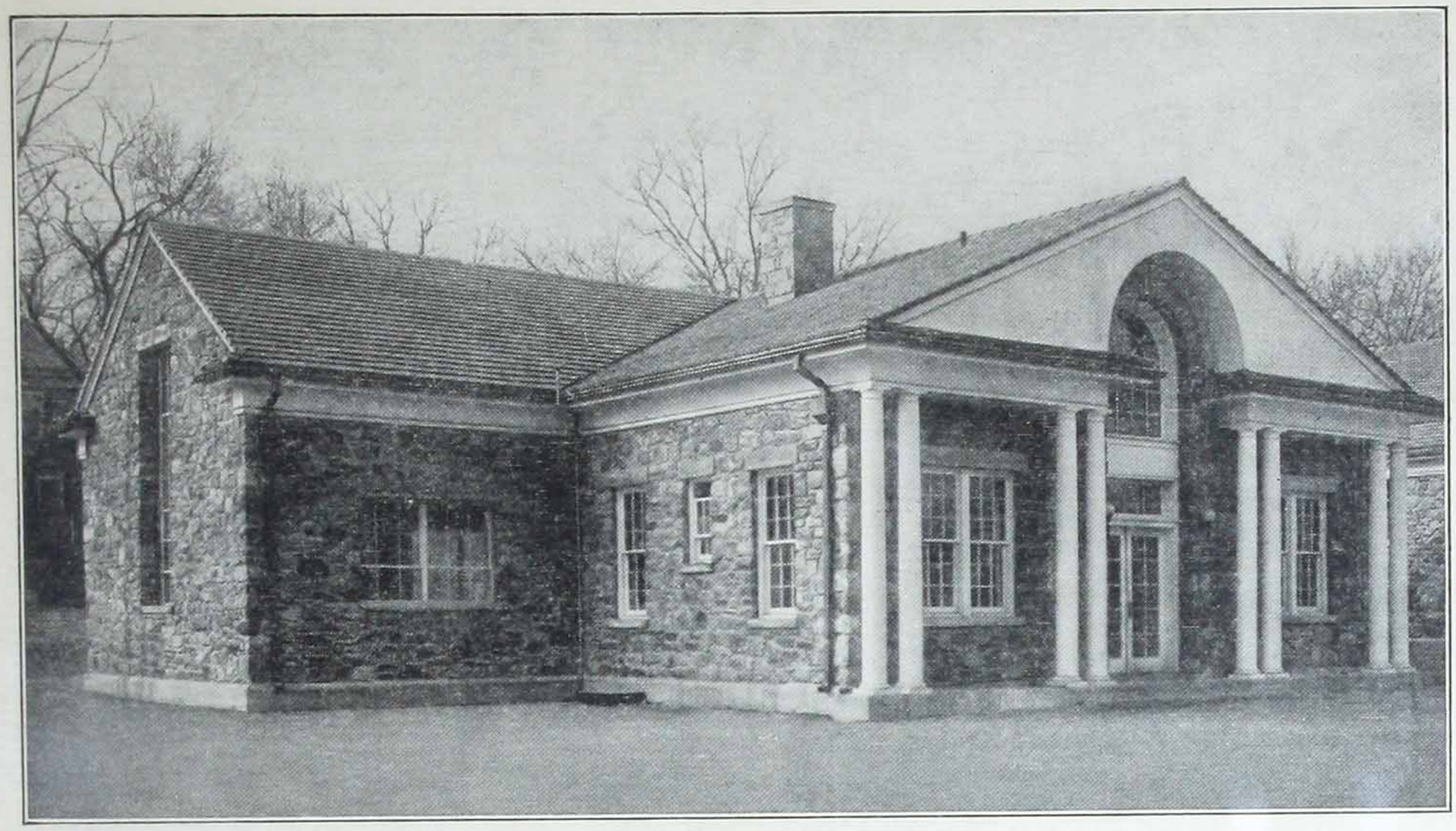


A Modern Sewage Screening Plant,
New Rochelle, N. Y.

SANITARY ENGINEERING BULLETIN

(1926)

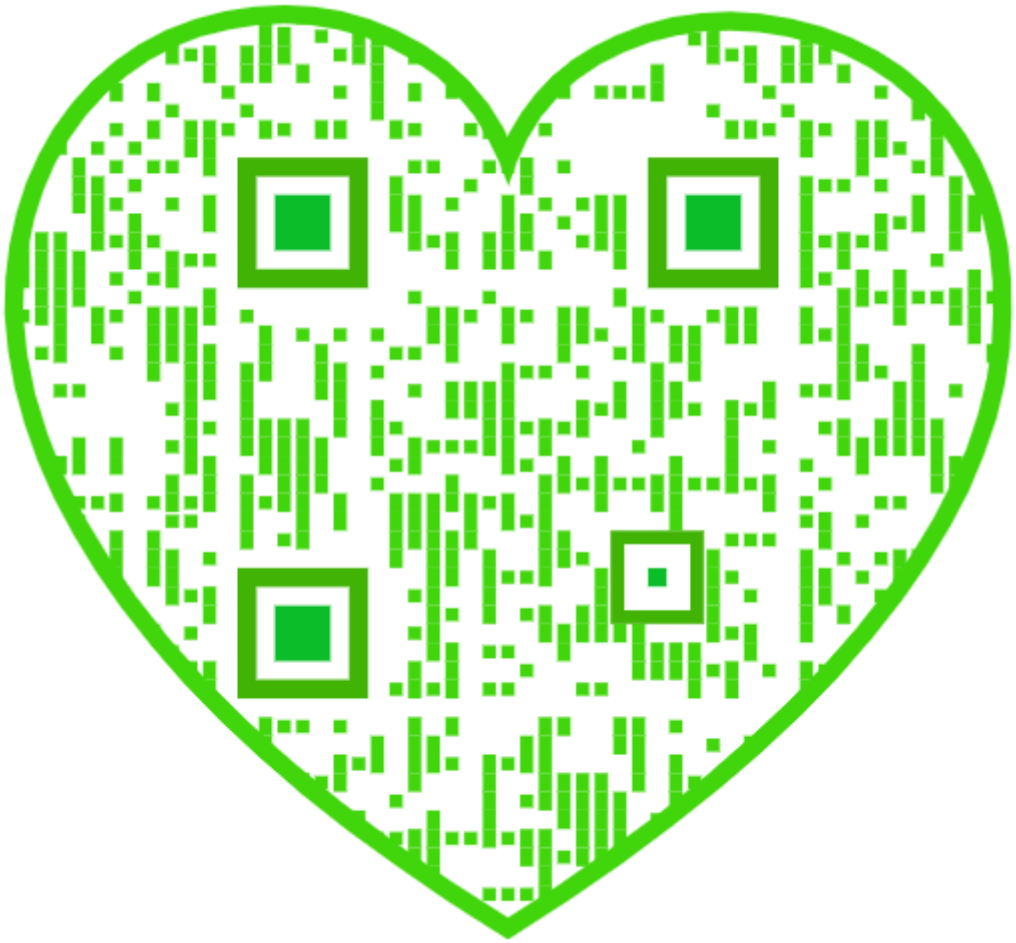
DORRCO

THE DORR COMPANY

ENGINEERS

247 Park Avenue, New York City

For Other Offices and Affiliated Companies see Back Cover



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Foreword

THE purpose of this bulletin is to discuss in a general way the application of Dorr equipment to Sanitary Engineering problems. Such problems are herein divided into three general classes: (a) The Treatment of Municipal Sewage, pages 3 to 12; (b) the purification and softening of water supplies, pages 13 and 14; (c) the treatment of industrial waste waters, pages 15 and 16.

The conditions affecting any particular problem in any of the three divisions usually require special study and the Sanitary Engineering Staff of the Dorr Company is composed of men familiar with the treatment of municipal sewage, industrial wastes, and with water purification, who are always ready to co-operate in every way with consulting engineers or others who may have such problems under consideration.

In the following pages merely the general aspects of the various methods of attacking Sanitary Engineering problems are touched upon.

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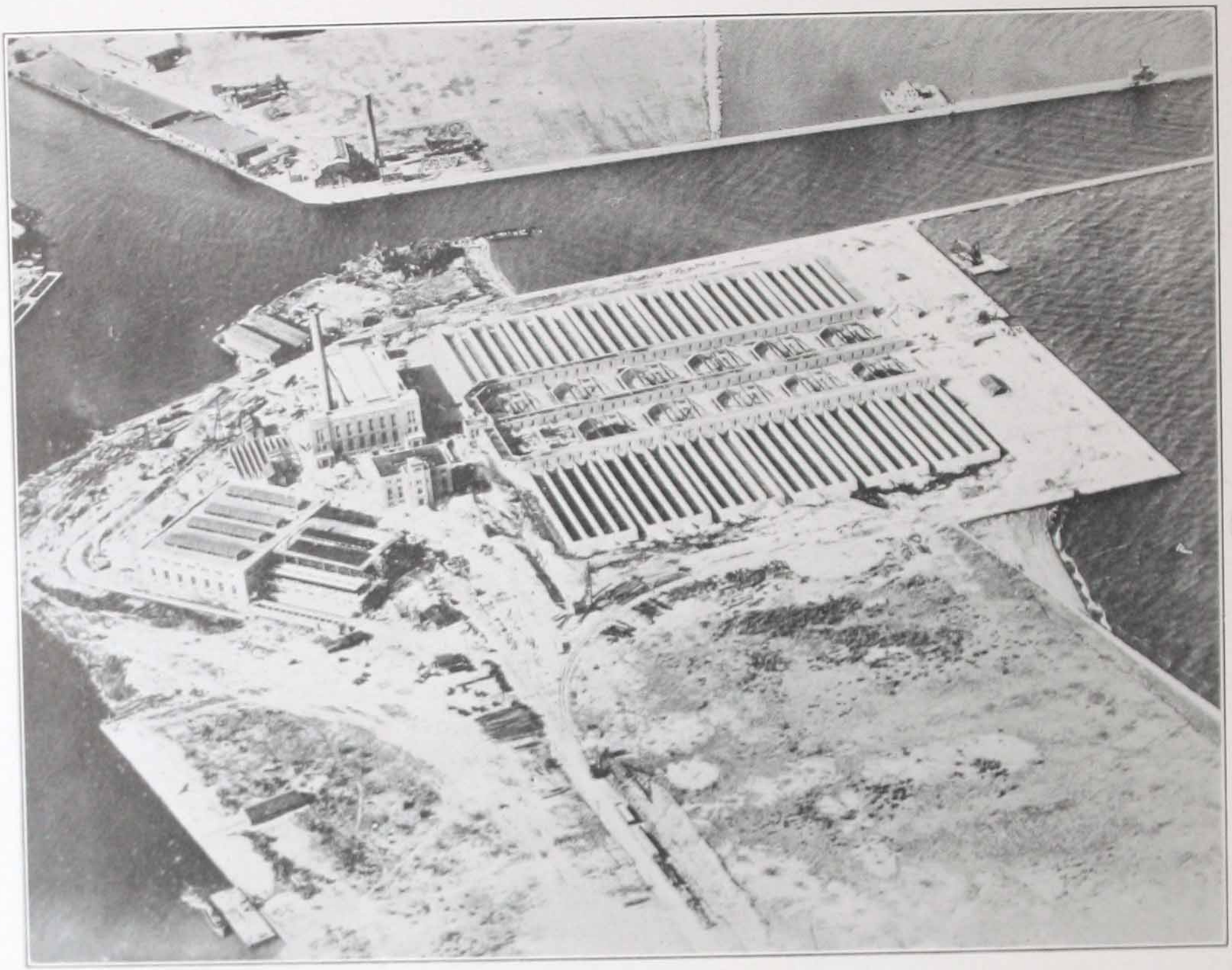


Aerial Photographic Service, Inc., Chicago

ACTIVATED SLUDGE PLANT AT MILWAUKEE, WIS.

In this plant, which has a capacity of 85 million gallons daily, eleven 98-foot and four 44-foot Dorr Clarifiers are used for sedimentation of the aerated sewage

The Treatment of Municipal Sewage

Introduction

THE kind and degree of treatment required for any sewage or industrial waste water can be determined only after a careful analysis of local conditions. Usually the treated sewage flows into creeks, rivers, lakes or the ocean, and the volume of the body of water ultimately receiving the sewage frequently determines the degree of treatment needed. Where the stream or body of water into which the sewage flows is large, partial treatment will generally suffice, but in some instances, although the sewage discharges into large bodies of water, complete treatment must be provided on account of the further use of the same body of water for domestic purposes.

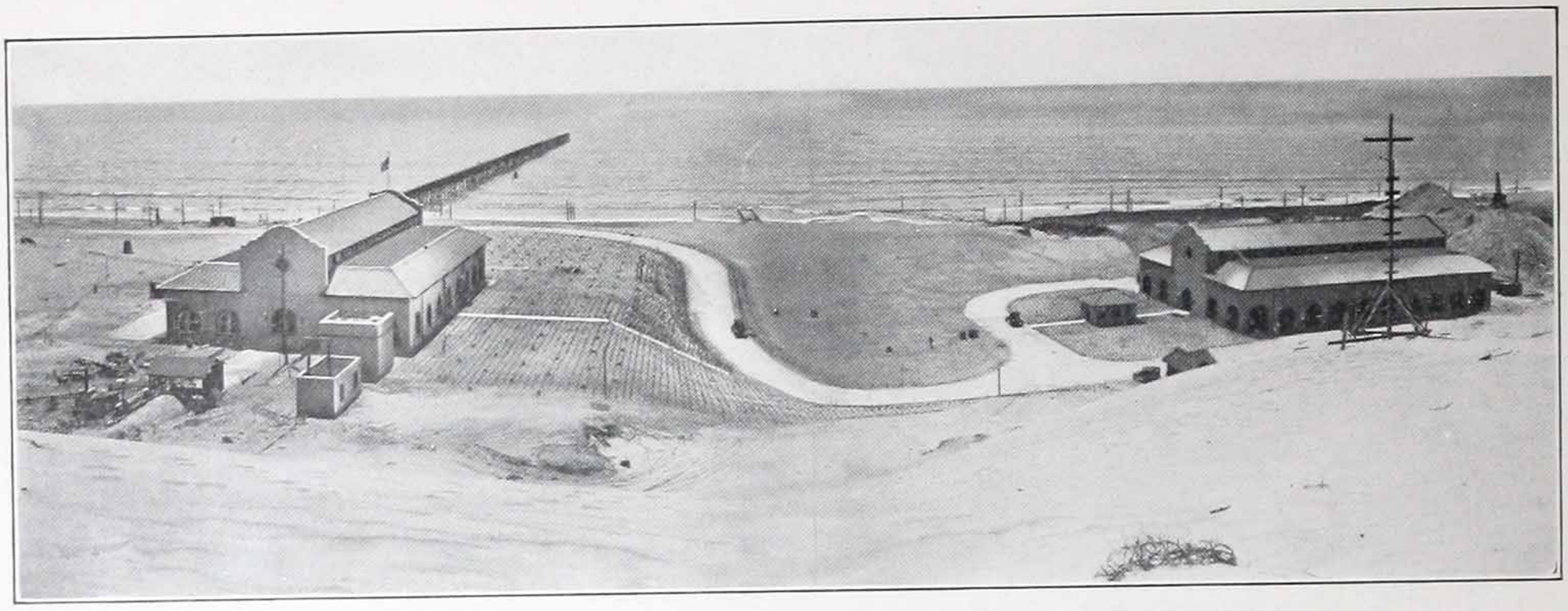
In certain districts bodies of moving water are not adequate for receiving a settled sewage. In these cases a high degree of treatment is often required so that, if desired, the effluent from the sewage treatment plant can be discharged into the watercourse without nuisance. In many instances the locations available for sewage treatment plants are adjacent to residential sections, so that regardless of the dilution available for the treated sewage the process adopted must be one which will be odorless and sightly and require a very limited area for the necessary plant.

Removal of the coarser solids will in some cases meet the local conditions, and this can best be accomplished by fine screening. In other cases the removal of the settleable solids is all that is required and this is accomplished by coarse screens followed by sedimentation. Where a greater degree of treatment is required than can be obtained by the removal of all of the settleable solids, chemical or bacteriological treatment must follow the steps of screening and sedimentation.

Regardless of the process to be adopted or the degree of treatment required, screening is usually the first step and sedimentation is often the second step. The efficiency of these steps has an important bearing on the type of secondary treatment to follow. Screening removes the bulky solids, some of which being inert, are frequently the cause of trouble in the secondary processes. These solids are often entirely different in character from the other solids in the sewage and therefore require different methods of handling. Sometimes these coarse, bulky solids have potential value when recovered from the sewage or industrial waste waters. Where bacteriological treatment is to be employed it is essential that the coarse, inert solids be removed before the treatment is started.

Where the activated sludge process is used, it is advisable, except in special cases, to remove all of the settleable solids before the final treatment is started,

as this results in lessening the air consumption, the period of treatment, and sometimes the size of the plant required. Sedimentation as well as screening offers a means of classifying the solids in the sewage so that different methods of disposal can be provided for the different grades of solids or sludge produced.



Screening Plants at Los Angeles, Cal.

Situated at Hyperion, the south plant installed in 1924 contains eight 8′ x 8′ Dorrco Screen Units while the north plant installed in 1925 is operating five 14′ x 12′ screen units

Screening

As a preliminary step in many methods of sewage treatment fine screening will reduce the amount of suspended solids to be removed by the subsequent steps, with a consequent direct saving in operating cost for the secondary process. For some communities located on the seashore, screening will prevent beach pollution, and that treatment, with or without disinfection of the screened effluent, will usually be all that is needed. Some of the cities using the Dorrco Screen Unit for this purpose are Atlantic City, N. J., Palm Beach, Fla., Los Angeles, Long Beach, Ventura, Venice, Cal., New Rochelle, N. Y., and many others.

The Dorrco Screen Unit

The prime function of mechanical screens is the effective separation of suspended solids from the liquid without clogging or blinding of the screening medium, and the dewatering and handling of the screenings to render them suitable for final disposal. The Dorrco screen unit was developed to meet these essential requirements. Its simplicity of design, combined with the positive, self-cleaning feature, assures efficient screening at very low cost for installation, operation and maintenance.

The Dorrco Screen Unit consists of a perforated cylindrical drum, mounted on a horizontal shaft, with the drum partially submerged in the sewage flow. The screened sewage after passing through the perforations into the cylinder, flows out through a discharge opening in one end of the drum. An effective seal around the discharge opening prevents unscreened sewage from by-passing the screening medium.

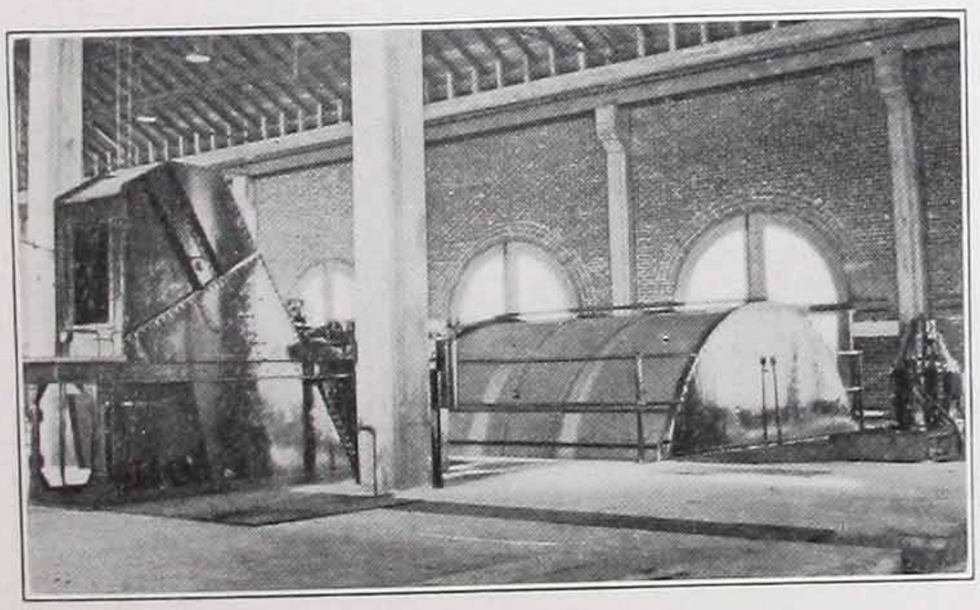
No brushes or other auxiliary devices are used to clean the screen plates, which are automatically cleansed by a flush of

screened sewage, produced by the action of the screen itself. This "cascading" action conveys the screenings into the screenings pit. Coarse or bulky solids which do not adhere to the revolving drum are ejected by means of spiral lifting fins attached to the outside of the drum.

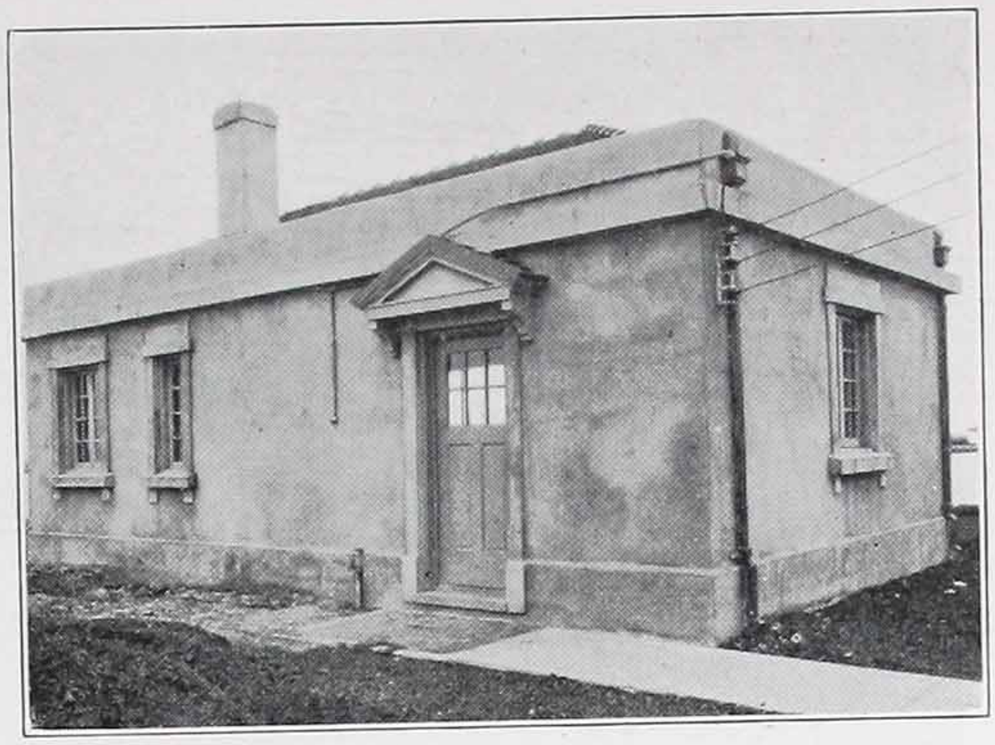
The screenings are removed from the pit by means of a slow moving screenings dewatering elevator equipped with specially designed buckets of perforated metal, which permit the superfluous water in the screenings to drain away during the travel of the buckets to the top of the elevator where the screenings are discharged into suitable receptacles or pneumatic ejectors, for removal to the point of final disposal. The screenings are discharged at or above ground level, thus eliminating the necessity for hoists.

The moisture of the screenings discharge is from 81-85%; the amount of solids removed varies with the size of perforations on the screen, the length of sewage travel, the strength of the sewage in suspended solids and size of sewage particles, but in a number of cases removals of 15 to 20% of the total suspended solids have been obtained.

The screen is driven by a direct-connected motor; the operating H. P. required is very small and averages less than ½ H. P. per million gals. treated.



One of the Five 14′ x 12′ Dorrco Screen Units in the North Hyperion Plant, Los Angeles



Chelsea Heights Screening Plant, Atlantic City, N. J.

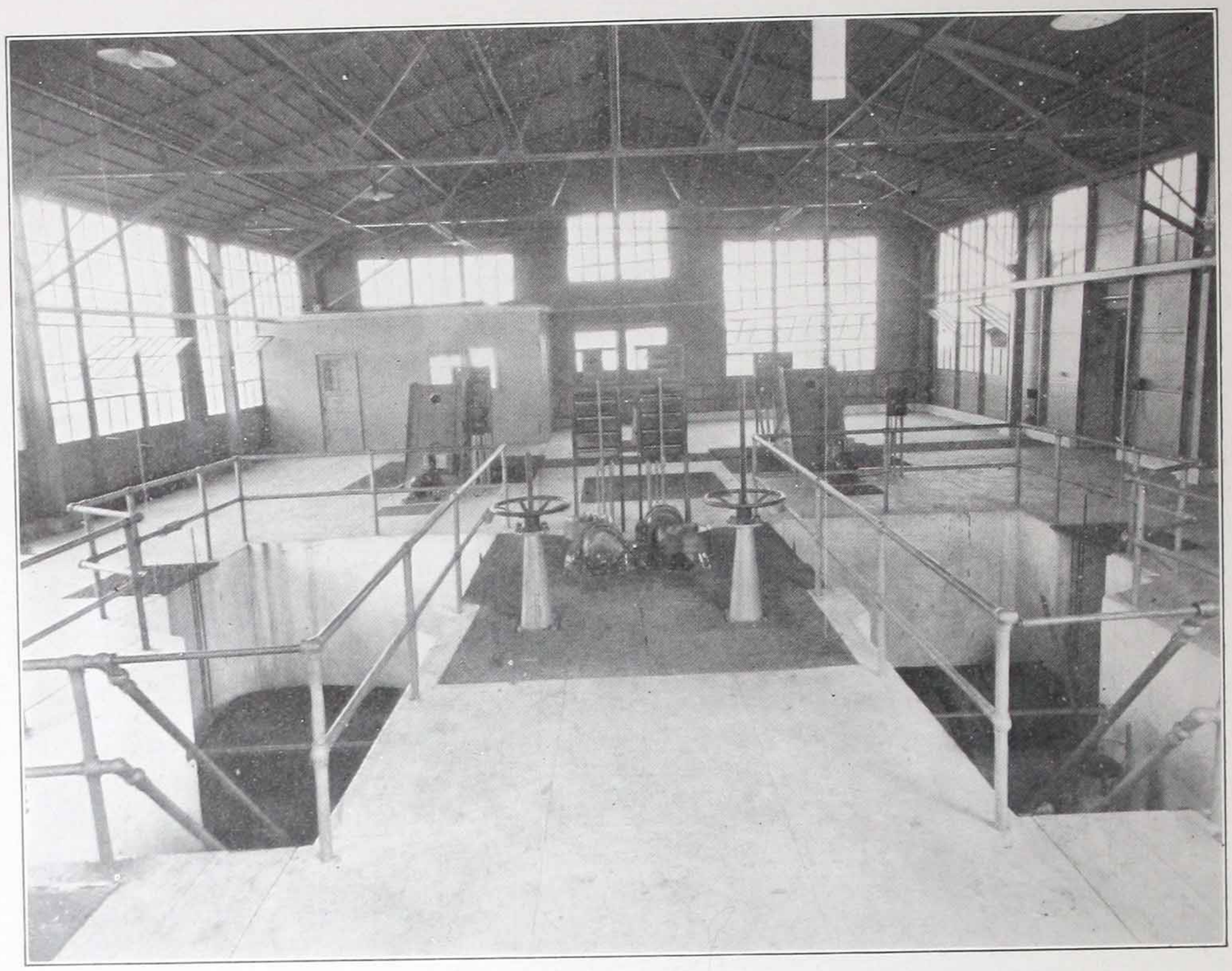
The 8′ x 3′ Dorrco Screen Unit installed here helps to keep the beaches of this famous resort free from pollution. Another Dorrco Screen Unit is installed at the Raleigh Avenue plant

As there are no scrapers or brushes in contact with the screen drum, no replacement of plates due to wear is necessary. Careful design and high quality workmanship ensure a sturdiness of construction that adds years to the life of the screen.

To meet different local conditions the screen is built in various sizes. Our engineers are in a position to give advice and recommendations as to the size of screen best adapted to the problem, and the data that we have gathered from a large number of operating plants is always available.

Uses of the Dorrco Screen Unit:

1. As the sole means of sewage treatment, where sufficient dilution is available to render further treatment unnecessary.
2. As the preliminary step to all other forms of sewage treatment.



Interior of Screening Plant at Long Beach, Cal., Showing the Two Dorrco Screen Units

Advantages:

1. Low cost of installation and operation.
2. High efficiency in removal of solids.
3. Screenings low in moisture, making easy handling.
4. Small area required.
5. Entirely self-cleansing, no brushes, scrapers, jets, etc., being required.
6. Manual attention negligible.
7. All parts accessible.
8. Quiet operation.
9. No breaking up of solids.

Sedimentation

As stated in the introduction to this section, sedimentation is often the second step in sewage treatment. In fact, it might be said that in practically all methods of sewage treatment effective sedimentation is the most important feature.

Leading sanitary engineers now recognize that by the adoption of the principle of continuous sedimentation marked improvements can be shown over old intermittent methods; while at the same time economies are effected in installation costs and operating expenses.

The Dorr Clarifier

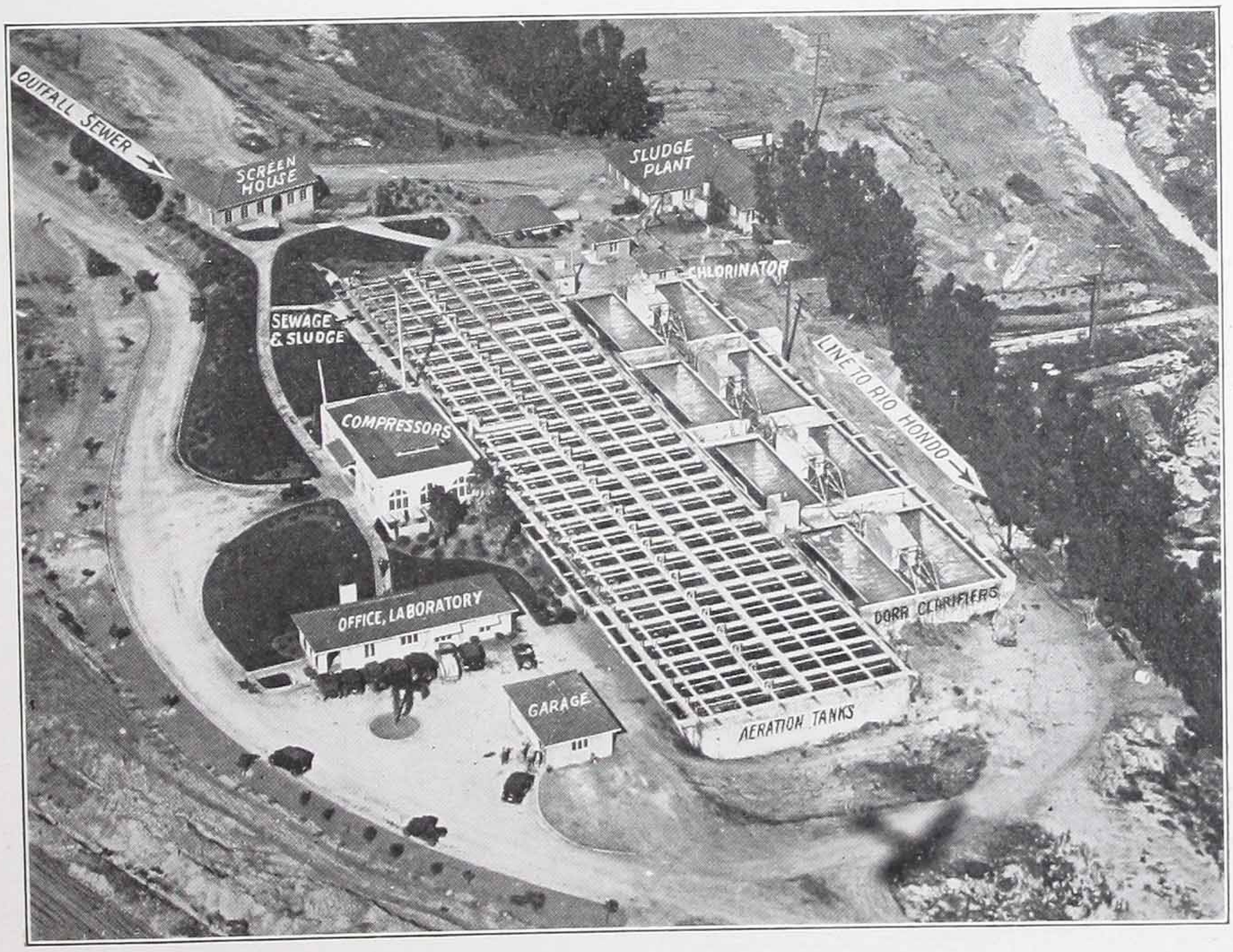
The Dorr Clarifier is a sedimentation basin equipped with a mechanism for the continuous collection and removal, in the form of a sludge, of the settleable solids in the sewage.

The shape of the sedimentation basin used is preferably square, but existing circular or rectangular basins may also be readily adapted. A large number of units in sizes ranging from 6′ to 200′ are now in operation for various sanitary engineering purposes.

Straight line flow is invariably adopted for these basins wherever possible as affording the best means of avoiding the currents and vertical velocities found in radial and upward flow tanks. The feed to the basin is therefore submerged below the water line and distributed along one side, behind a suitable baffle, while the clarified effluent flows over an adjustable weir on the opposite side. The operation of the basin is continuous in action, the well thickened sludge being removed at substantially the rate of deposition, thus making the designed sedimentation capacity always available.

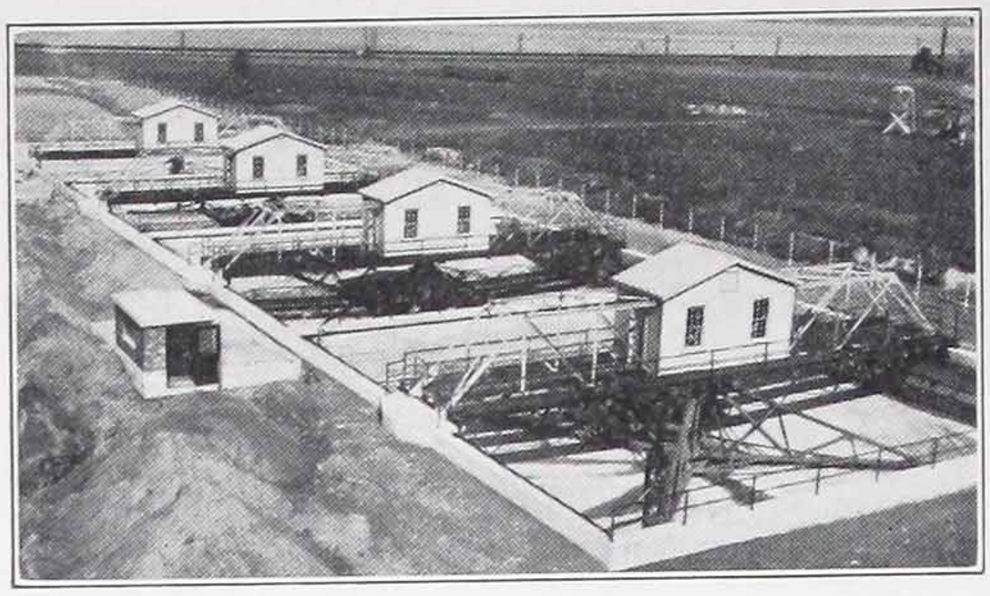
The side water depths may be shallow, usually from 6′ to 7′, and the bottom is given a slight uniform slope towards a central sludge outlet.

The mechanism consists of radial arms, each equipped with plows set at an angle to them, which sweep the entire floor of the basin, collecting and partially dewatering the sludge by compression and the rolling action imparted to the sludge



General View of Activated Sludge Sewage Disposal Plant, Pasadena, Cal.

Two Dorrco Screen Units are operating in the screen house. Dorr Clarifiers at the right of picture



FOUR 71-FOOT DORR CLARIFIERS IN THE SEWAGE TREATMENT PLANT, SYRACUSE, N. Y.

This is a straight sedimentation plant, the clarifier effluent runs direct to the lake, while the sludge is pumped over three miles to a waste industrial lime dump

by the rakes, while conveying it to the central discharge point. The mechanism operates continuously, but the sludge may be withdrawn at intervals or continuously as conditions demand, by means of hydrostatic pressure, pump or air lift.

The operating speed of the arms is very slow, the peripheral speed of the ends of the arms being designed to prevent any vertical disturbance or agitation of the sludge which is being handled.

Owing to the slow speed, the horsepower requirements are exceedingly small, 1 H. P. being sufficient to operate a 50′ Clarifier.

All main bearings are situated above the water line, and the whole of the mechanism is designed for long life and continuous operation. Apart from the supply of power, the only operating expenses consist of periodical lubrication and the adjustment of sludge withdrawal.

As the mechanism is entirely suspended from above the water, the tank does not have to be emptied to adjust the contact of the squeegees on the rakes with the bottom. A lifting device allows the rakes to be raised or lowered very easily from the superstructure. This easy adjustment eliminates any possibility of the rakes dragging on the concrete bottom.

The mechanism is fitted with an overload alarm device and automatic cutout switch which obviates the necessity for constant manual supervision, and also prevents damage or breakage.

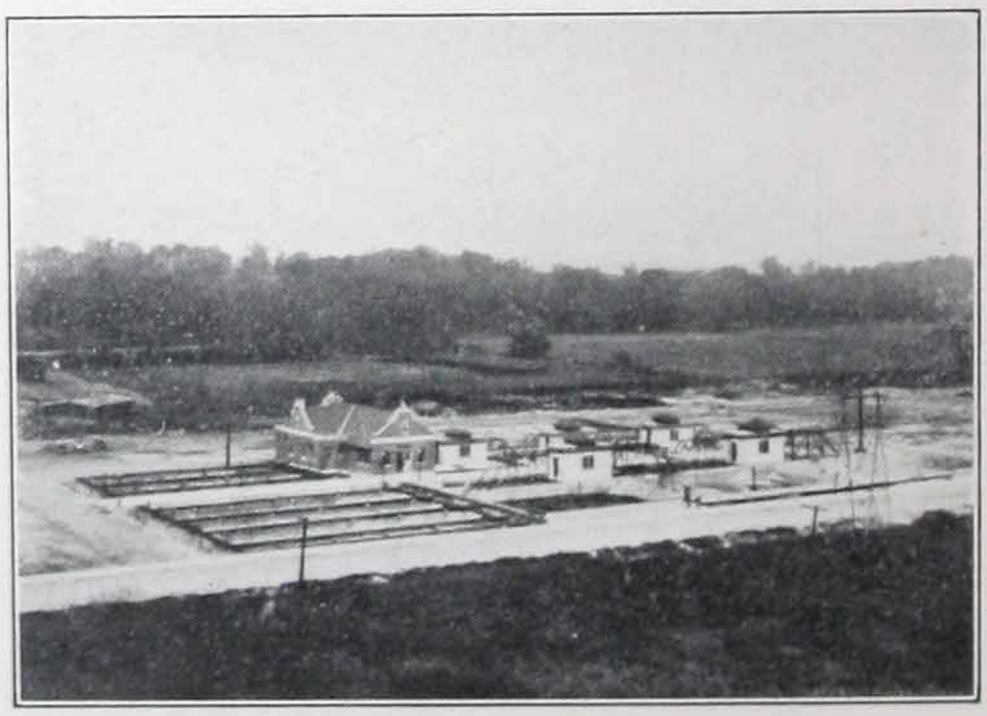
The sludge produced is very low in moisture content when compared with the sludges produced by other types of tanks under similar conditions, and when operating in activated sludge plants, the sludge is handled so rapidly and is discharged in such a healthy condition that subsequent re-areation has been found unnecessary.

Uses of the Dorr Clarifier

The Dorr Clarifier is applicable to the sedimentation of—

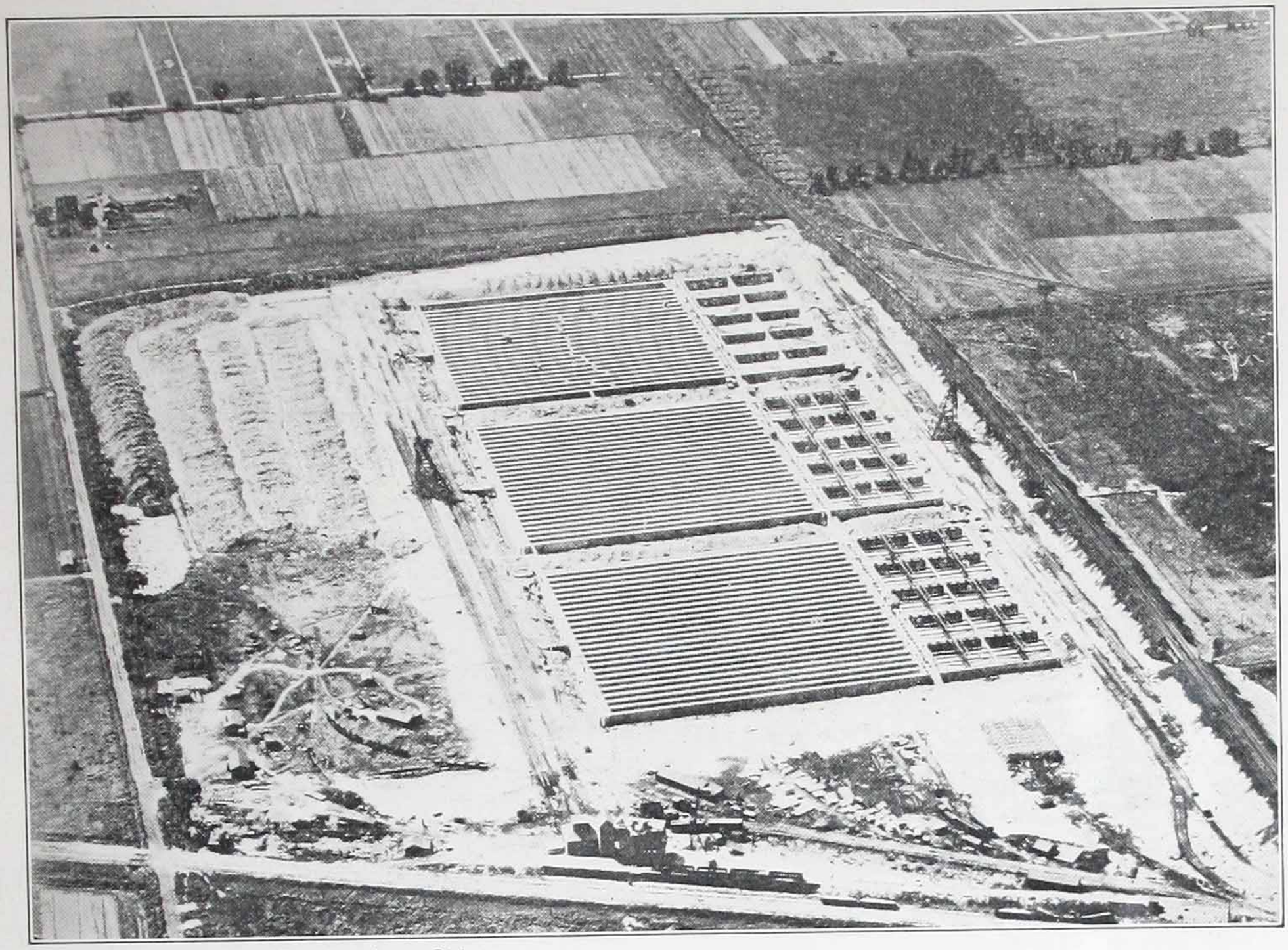
1. Raw or screened sewage, with or without chemical precipitation.
2. Activated sludge, before and after aeration.
3. Trickling filter effluent, or humus tanks.

It is also adapted for increasing the



ACTIVATED SLUDGE PLANT AT YORK TOWNSHIP, ONT.

Showing Dorr Clarifiers at right. Dorr equipment is operating in many sewage plants in Canada



Aerial Photographic Service, Inc., Chicago

SANITARY DISTRICT OF CHICAGO, NORTH SIDE PLANT

When completed this activated sludge plant will be the largest in the world. Eight 80-foot Dorr Clarifiers will be used as pre-sedimentation units, while thirty 77-foot Clarifiers will be used for sedimentation of the aerated sewage

capacity of old plants, without scrapping present units.

Its use in connection with the treatment of industrial wastes, and of water will be discussed in the ensuing sections.

Advantages:

1. Ease and certainty of control yielding uniformity in clarification, and consistency in sludge produced.
2. Continuous and rapid mechanical removal of sludge by which the efficiency of the sedimentation basin is maintained, and a dense, healthy sludge is produced, thus greatly simplifying its subsequent treatment. The continuous removal of sludge eliminates the danger of septic action in the tank.
3. Low installation and operating costs, due to the use of simple shallow tanks, the reduction in number of units required, the reduction of manual labor costs to a minimum, and very small amount of power required.

Separate Sludge Digestion

It is now generally conceded that the principle of sedimentation and sludge digestion in one tank which involves deep excavations, complicated form work, etc.,

is a costly one and that at least the same results can be obtained more economically by using separate units for sedimentation and for sludge digestion.

The flow sheets on page 11 illustrate types of plants that are in successful operation not only in warm climates, but in districts where the thermometer drops to from 30 to 40 degrees below zero in the winter months.

The Dorr Digester

This unit includes a mechanism for distributing the incoming raw sludge evenly over the surface of the digestion liquor and for breaking up the scum. It is also equipped to prevent the formation of dead zones around the margin of the tank bottom and to assist in the withdrawal of the sludge from the central discharge cone. This allows flat bottom construction of the sludge digestion tanks.

Pumping

For handling non-homogeneous materials such as sewage sludges, containing lumpy or stringy materials, the diaphragm type of pump has been recognized as the most efficient and trouble-proof. The Dorr Company has made a special study of such pumping problems and has developed a pump which has proved entirely satisfactory under the most trying operating conditions.

The Dorrco Sludge Pump

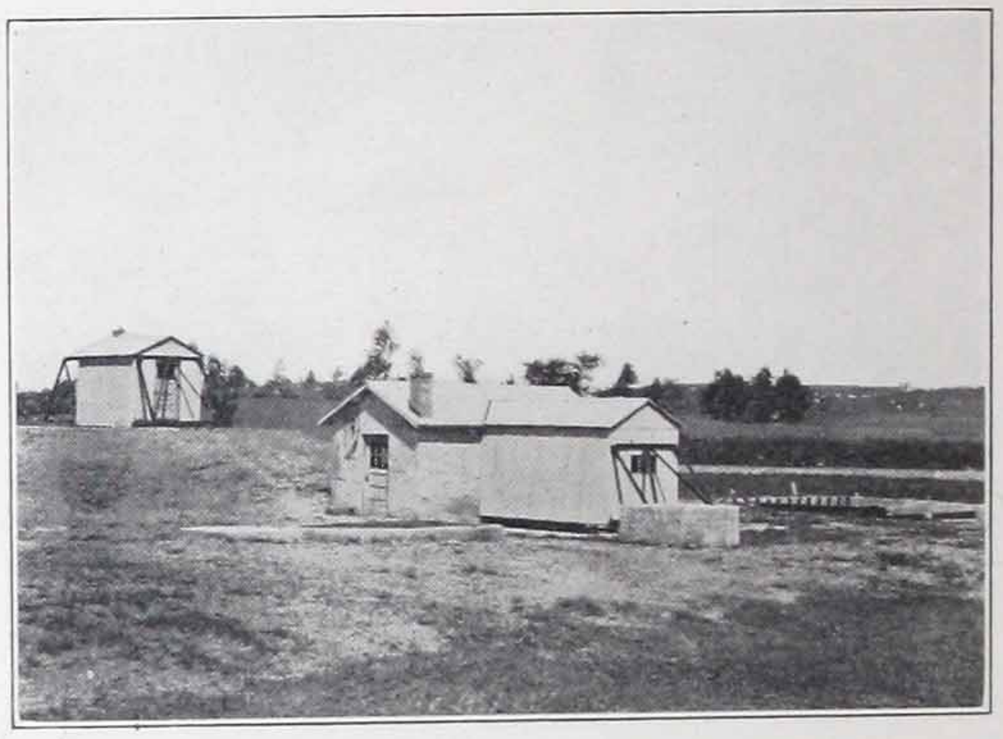
Suction Type

This type of pump is designed for use in plants where a suction lift of six to eight feet is necessary, the sludge discharging by gravity over a lip in the pump bowl.

Close control over the amount of sludge withdrawn can be maintained, as the stroke of the pump may be varied by means of an adjustable eccentric on the drive shaft.

Pressure Type

Where it is desired to lift the sludge to higher elevations or convey it through long horizontal distances, as will usually be the case in sewage plants, the Dorrco Pressure sludge pump should be used.



SEPARATE SLUDGE DIGESTION PLANT AT KIEL, WIS.

The Clarifier is at right of photo, while the Dorr Digester is seen at the left

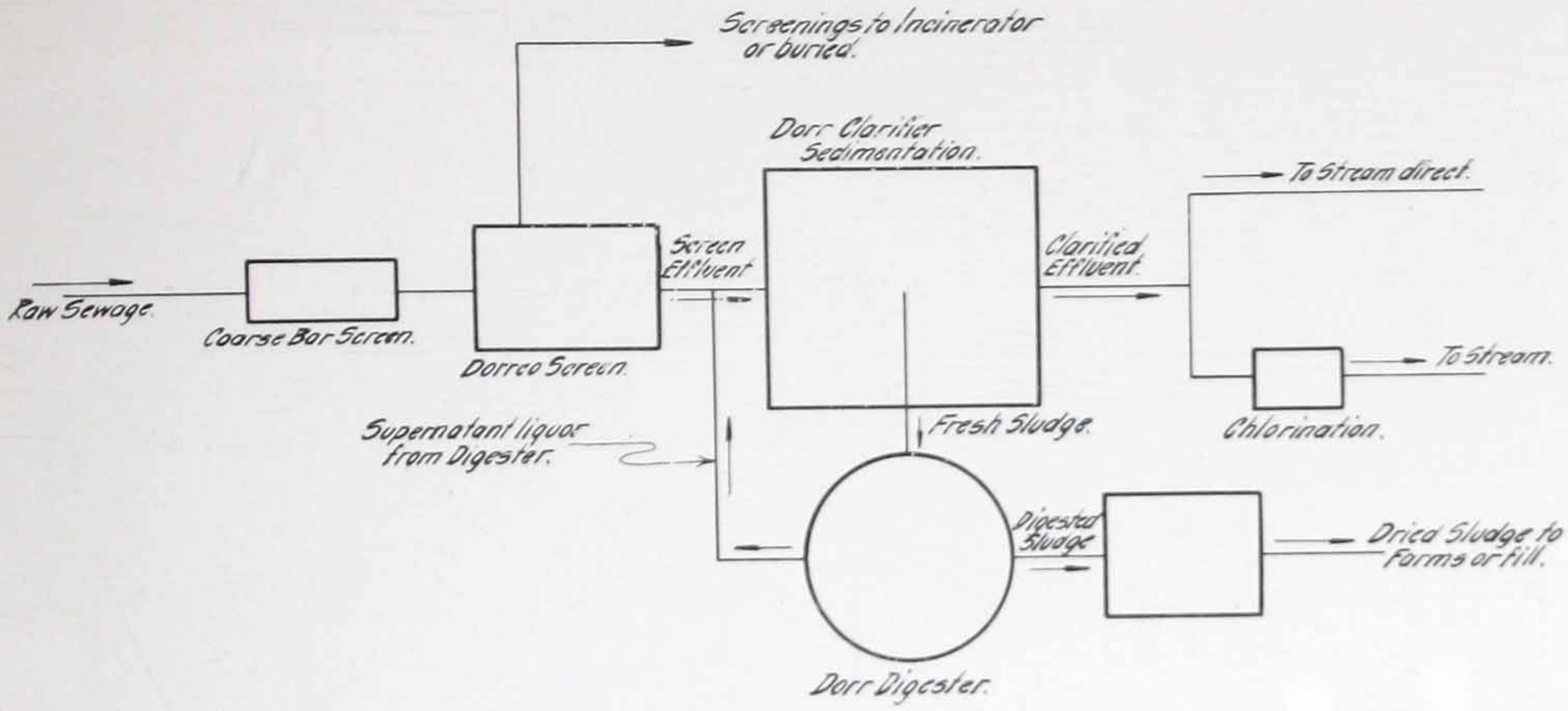
This pump will work against pressure heads of from 30 to 40 feet without noticeable strain on the diaphragm. As is the case with the suction pump the stroke is adjustable and all parts are readily accessible.

The pump is noiseless in operation, being operated by a direct connected motor with silent chain drive.

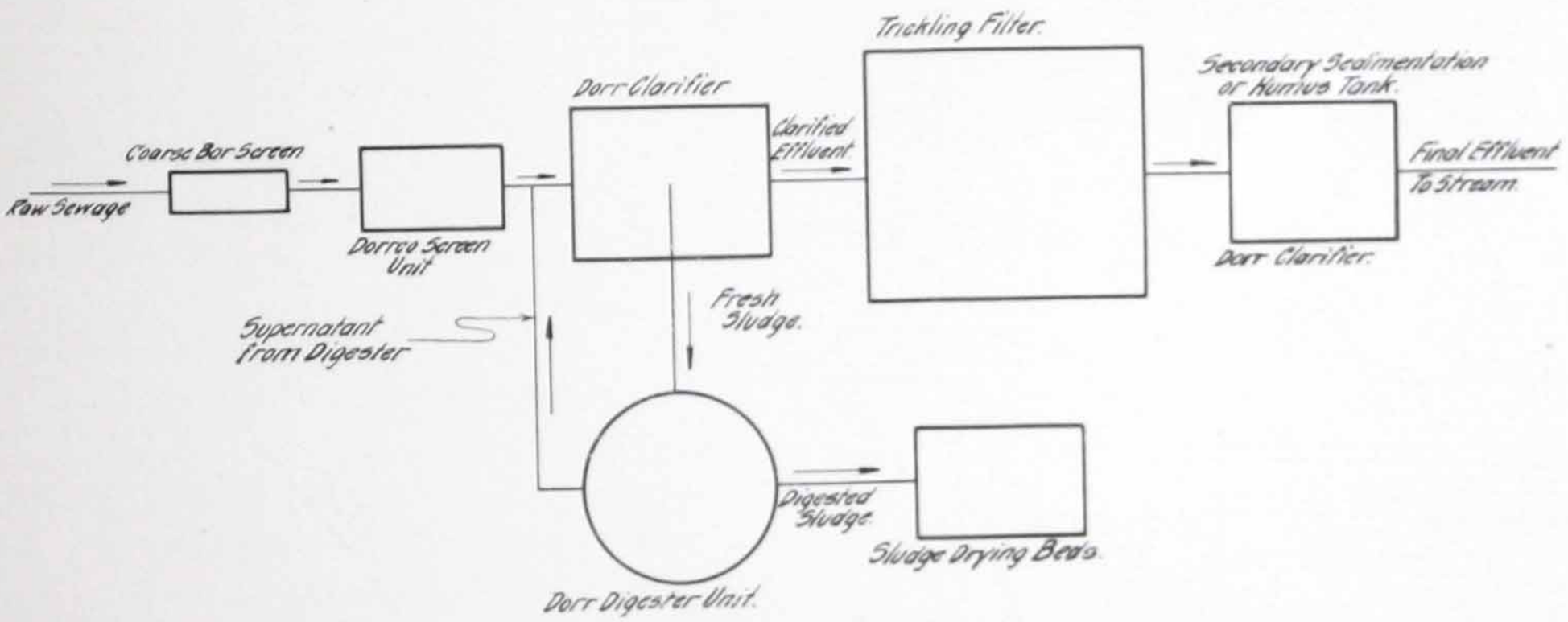
Full description of these pumps will be sent upon request.

They are adapted not only to removing sludge from the Dorr Clarifier, but to any sludge pumping problem.

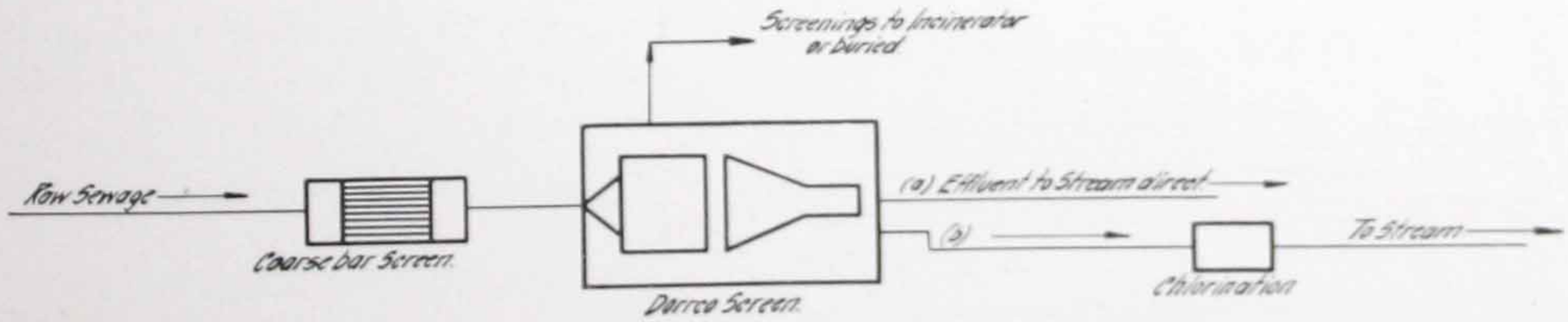
MECHANICAL SCREENING WITH SEDIMENTATION & SEPARATE DIGESTION OF SLUDGE



SEDIMENTATION & SEPARATE DIGESTION WITH TRICKLING FILTERS.

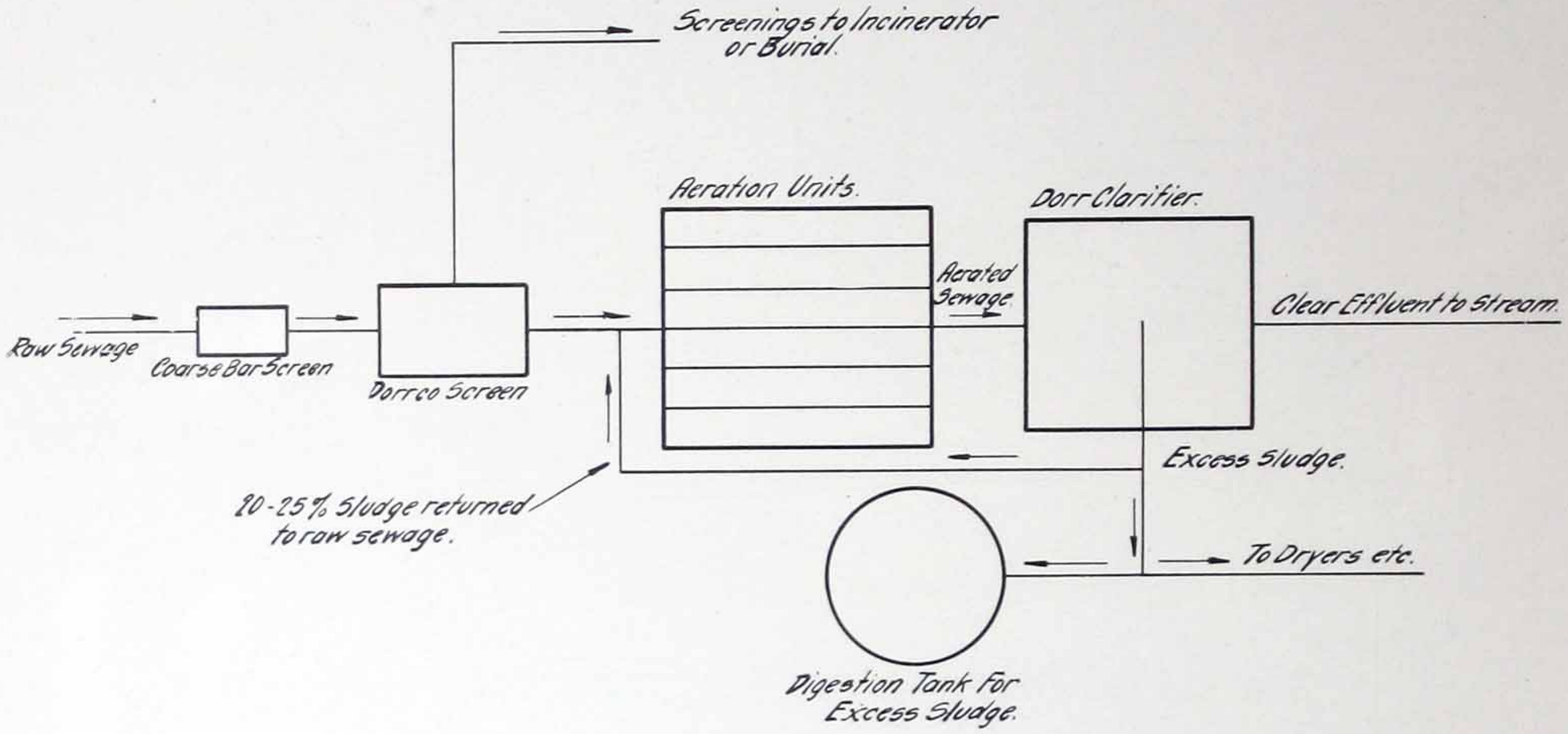


MECHANICAL SCREENING

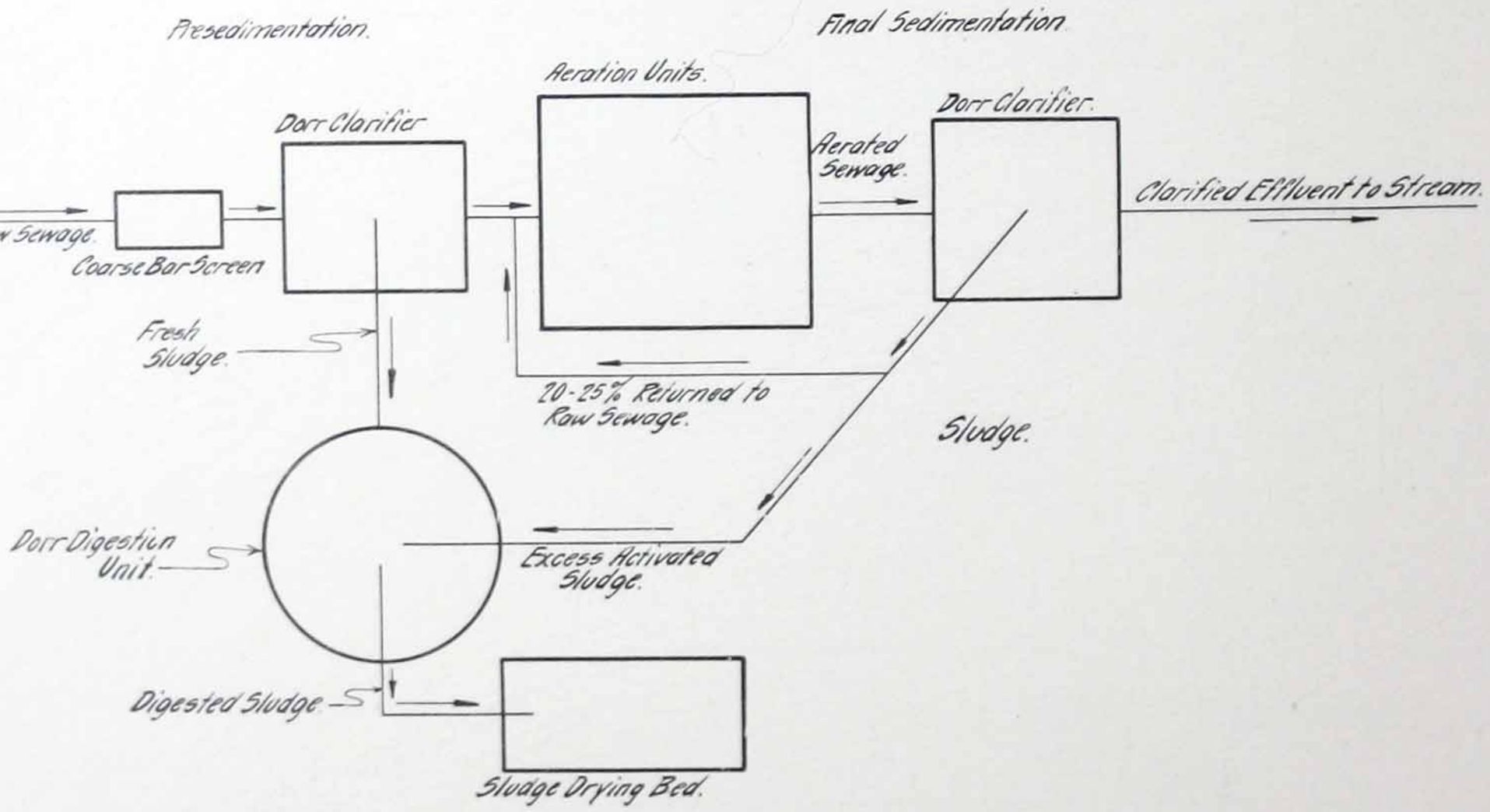


TYPICAL FLOW-SHEETS

ACTIVATED SLUDGE WITH FINE SCREENING.

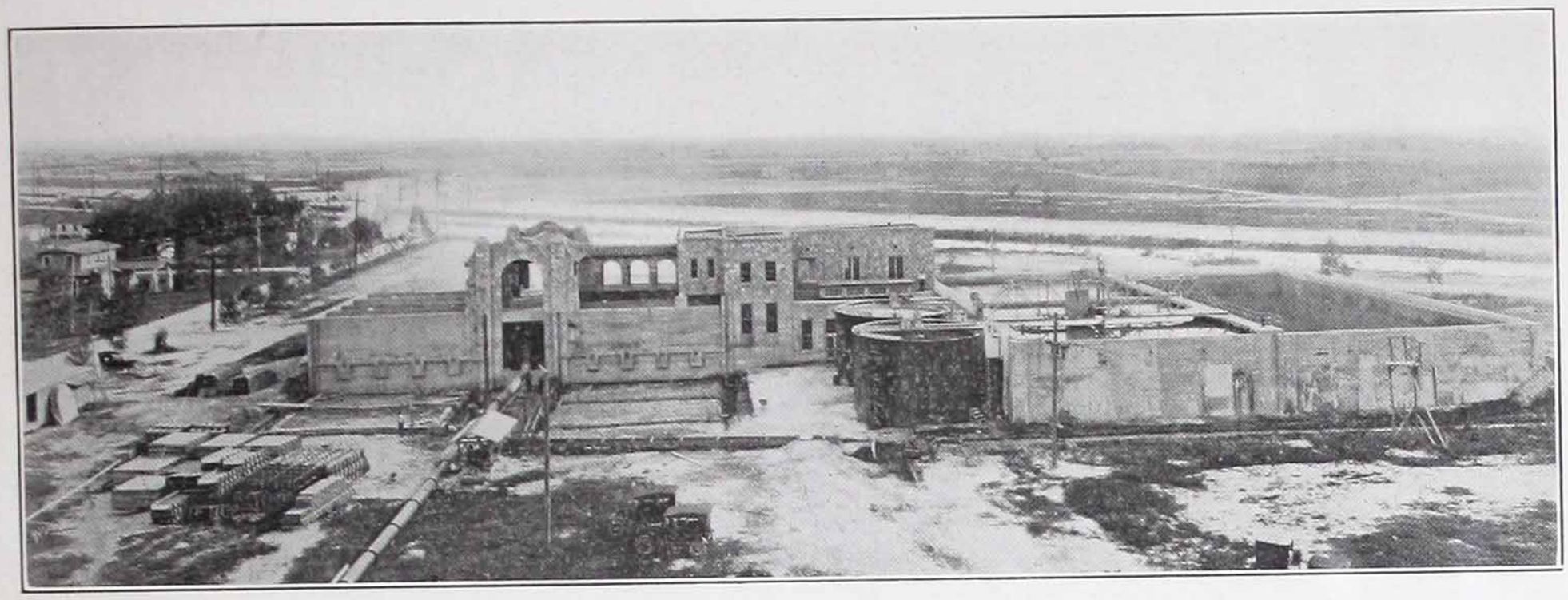


ACTIVATED SLUDGE WITH PRESEDIMENTATION.



TYPICAL FLOW-SHEETS

The Purification and Softening of Water Supplies



WATER SOFTENING PLANT AT MIAMI, FLA.

The Dorr Clarifier, shown at right centre of photo, is used for sedimentation of precipitated sludge

Introduction

WITH the growth of population and the spread of industry, the problem of maintaining a pure water supply is becoming more and more acute in the congested sections of the country. There is probably no factor which is as vital to the health of a community as an adequate supply of pure drinking water, and the great decrease in the typhoid death-rate in the past decade is due not only to more sanitary methods of sewage disposal, but also to the fact that modern, well-equipped water treatment plants are now coming into general use.

The great benefits to be derived from water softening are now also realized in those regions where only a natural hard-water supply is available.

Uses of Dorr Equipment

When turbid and muddy waters are the source of supply, the Dorr Clarifier (p. 6) is used in removing the bulk of suspended solids prior to the addition of chemicals for coagulation. The removal of these solids materially reduces the cost of chemicals required.

The Dorr Clarifier is also used on highly colored waters to remove the alum floc or other precipitates before the water enters the settling basins. A uniformly thick sludge can continuously be discharged, resulting in smaller basins and reduced water waste with sludge.

In water softening plants Dorr Clarifiers are installed as sedimentation units to remove the precipitated solids before filtration of the water. The continuous removal of the settled solids allows the full volume of the tanks to be always available, and eliminates excess capacity for sludge storage.

Advantages of the Dorr Clarifier:

1. Reduced settling volume required, as sludge storage space is eliminated.

Construction cost of the basins is therefore materially lowered.

2. Duplicate units—one in use, while the other is being cleaned out—are not necessary, as the clarifier continuously removes sludge without draining basin.

3. The continuous discharge of a small quantity of sludge into the river reduces pollution to a minimum. The intermittent cleaning of old types of basins, when sludge discharge is concentrated, discolors streams for many weeks.

4. The Clarifier facilitates the return of sludge to the mixing basins, which tends toward the acceleration of the reaction between the chemicals added and the water, and encourages the formation of larger flocs, thus increasing the settling rate of the solids.

5. Power cost to operate the clarifier is low. The cost of labor required for cleaning old type basins, and of water saved, which formerly was wasted, pays for the power many times over.

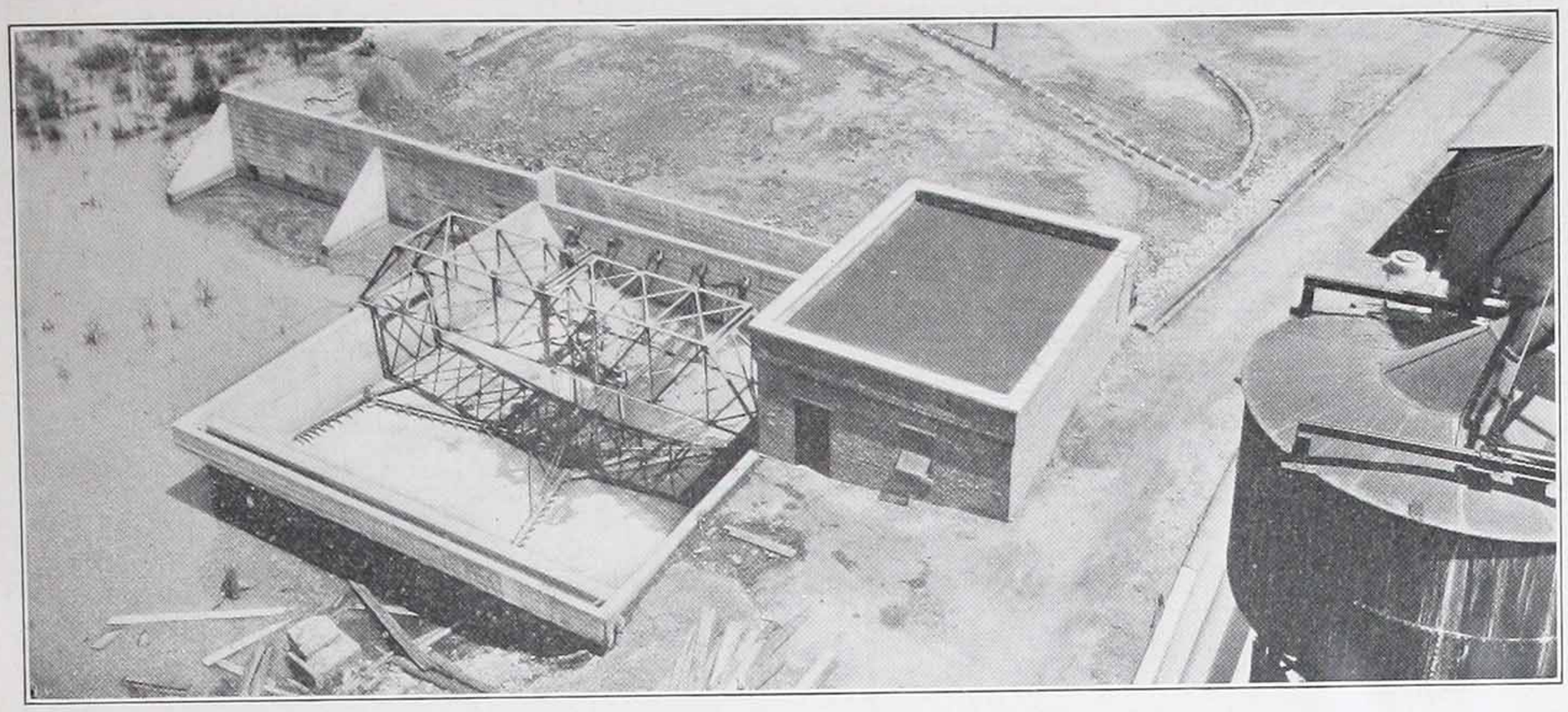
6. Basins may be constructed below ground level, as periodical emptying by gravity is not required.

The Dorr Mixer

The Dorr Mechanical Mixer has been especially developed for use in all cases where chemical "dosing" is required. It is particularly applicable for thorough and efficient mixing of lime, soda ash, alum or other chemicals with water supplies, previous to sedimentation.

Dorr Clarifier in the Water Treatment Plant at Piqua, Ohio

The Treatment of Industrial Wastes



Waste Treatment Plant of the Standard Bleachery Co., Carlton Hill, N. J.

Introduction

INDUSTRIAL wastes, the liquid discharge from manufacturing plants, present one of the most serious sources of stream pollution. The common practice of discharging these wastes into the most convenient watercourse has given rise to many complaints; and state and municipal health agencies are taking steps to either compel the discontinuance of the discharge of these wastes into streams or require the treatment of them to produce a satisfactory effluent.

As industrial wastes are a natural product of many manufacturing processes, it would be imposing an undue financial burden on the manufacturer to compel him to cease discharging into a stream entirely; therefore, treatment becomes the most logical step.

Differences in processes, character of water, etc., make it necessary to investigate every industrial waste problem, individually, and to make the necessary tests upon samples of the particular waste to determine the best and cheapest way to treat it.

Pollution by industrial wastes is of three kinds, as indicated, and it is possible to have a waste which is polluting in one or all of the three possible ways.

1. Color.
2. Poisonous or deleterious substances, causing illness and discomfort to animal and human organisms.
3. Deposits: Putrescent or obstructional, causing odors or obstacles to navigation and commerce.

Certain wastes, although high in color, are not dangerous in themselves, but, on the other hand, as they contain chlorine or chlorine derivatives, they are actually beneficial in destroying pathogenic organisms existing in a water supply.

The removal of any one or all of the objectionable contents is a problem which although varying in the degree of diffi-

culty of solution, can usually be solved reasonably economically and entirely satisfactorily. Methods of treatment of wastes from the following industries have been successfully developed by us, and plants have been installed in which the investigational work has been applied on a working scale and demonstrated to be practical and economical.

Tanneries
Canneries
Packing Houses (Meat)
Milk products factories
Textile Mills
Dye factories
Iron and Steel Mills
Paper Mills
Rubber Reclaiming plants
Roofing Manufacturing
Asbestos Manufacturing
Gas Plants
Oil Refineries
Glue and Gelatine factories
Cornstarch
Coal Washeries
Mines

We maintain a staff of trained engineers and chemists and a completely equipped laboratory and testing plant, and are prepared to co-operate with manufacturers and engineers in developing a method of treatment for any industrial waste.

Our service includes a thorough investigation of the problem; testing of sample of the waste; development of a method of treatment; a layout of the units of Dorr equipment that will assist in the economical solution of the problem, including the complete mechanical equipment required, such as Dorr units, chemical feeding devices, pumps, regulating devices, etc.; and engineering service in connection with the setting up and starting of the plant.

Uses of Dorr Equipment

The use of the Dorrco Screen unit (p. 4) on wastes containing sizeable particles, has been particularly successful in the treatment of wastes from tanneries, canneries and glue and gelatine factories.

In the treatment of tannery and glue factory wastes the Dorrco Screen will remove practically all of the hair and coarser solids, thus easing the load on the sedimentation unit and making it possible to dispose of the material to better advantage.

The economical removal of the settleable or precipitated solids has been facilitated by the use of the Dorr Clarifier (p. 6) and there are installations of this unit on all of the types of waste mentioned above.

Equipped with the Dorrco Sludge Pump (p. 10), or without if gravity discharge is available, the Clarifier provides a highly efficient and satisfactory sedimentation unit, which operates continuously and makes it unnecessary to provide duplicate basins. If the waste is such as to produce a floating scum, the Clarifier may be equipped with a mechanical scum collector or skimmer.

The cost of operation of Dorr equipment is extremely low. All parts are slow moving, and as they usually run 24 hours a day, the wear and tear entailed by intermittent operation is eliminated and power costs are reduced.

The Dorrco Screen, the Dorr Clarifier and the Dorrco pump are made in a number of convenient and practical sizes, so that a unit can readily be provided to suit the needs of each case.

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API INTERNATIONAL

CCA

CHICAGO	310 South Michigan Ave.
LOS ANGELES	108 West 6th St.
DENVER	1009 17th St.
WILKES-BARRE	536 Miners Bank Bldg.
JOPLIN	319 Joplin National Bank Bldg.

LONDON	The Dorr Company, Ltd., 16 South St. E. C. 2
BERLIN	Dorr Gesellschaft m. b. H., Joachimstahler Strasse 10, W. 15
PARIS	Societe Dorr & Cie. 126 Rue de Provence

JOHANNESBURG South Africa.	E. L. Bateman, The Corner House (Special Representative)